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BRIEF - PATENTS

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Applicant:	M.R. Toland	Attorney Docket No.	WEYE121907/22822C
Application No:	10/680,676	Group Art Unit:	1651
Filed:	October 7, 2003	Examiner:	L.B. Lankford, Jr.
Title:	METHODS FOR CLASSIFICATION OF SOMATIC EMBRYOS		

APPELLANT'S APPEAL BRIEF

Federal Way, Washington 98063
February 24, 2006

TO THE COMMISSIONER FOR PATENTS:

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MAIL STOP APPEAL

BRIEF - PATENTS

TABLE OF CONTENTS

I. REAL PARTY IN INTEREST

The real party in interest is Weyerhaeuser Company, a Washington corporation, having a principal place of business at 33663 Weyerhaeuser Way South, Federal Way, Washington 98063. Assignment of the present patent application and the invention from the parties named in the application to the real party in interest was recorded at Reel 011948, Frame 0513.

II. RELATED APPEALS AND INTERFERENCES

This application is a divisional of Application No. 09/700,037. Another divisional Application No. 10/680,675 was also filed based on Application No. 09/700,037. Both Application Nos. 09/700,037 and 10/680,675 were finally rejected on June 20, 2005, and appealed. Appellant's Appeal Brief in each of these cases is concurrently filed with the present Brief.

III. STATUS OF CLAIMS

Claims 1-14 are pending in this case. All Claims 1-14 have been finally rejected in the final Office Action mailed June 20, 2005, and appealed.

IV. STATUS OF AMENDMENTS

There are no outstanding amendments to this application.

V. SUMMARY OF CLAIMED SUBJECT MATTER

Claim 1 is the only independent claim pending in the present application.

Claim 1 is directed to a method for classifying plant embryos according to their quantifiable characteristics, such as their potential to successfully germinate and grow into normal plants, based on digital image data obtained from the plant embryos. The method involves generally four steps. First, raw digital image data are obtained from reference plant embryos of known quantifiable characteristics. In a simple case, the reference plant embryos of known quantifiable characteristics are divided into two groups: those that are known to have favorable quantifiable characteristics, e.g., those that are likely to geminate and grow into normal plants; and those that are known to have unfavorable quantifiable characteristics, e.g., those that are unlikely to germinate and grow into normal plants. (Their quantifiable characteristics are known based on a follow-up study, for example.) Thus, each set of the raw digital image data obtained from each reference plant embryo is correlated to the known quantifiable characteristics of that reference plant embryo.

Second, a single metric classification model is developed, using generally four sub-steps. In step (1), a metric value is calculated from the acquired raw digital image data of each embryo of known quantifiable characteristics. "Metrics" refers to "any scalar statistical value that captures geometric, color, or spectral features which contains information about the embryos, such as central and non-central moments, function of the spectral energy at specific wavelengths or any function of one or more of these statistics." (Page 10, lines 8-11, of the specification.) In step (2), the metric values obtained above are divided into two sets of metric values according to their known quantifiable characteristics. In step (3), a Lorenz curve is calculated from the two sets of metric values. In step (4), any point on the Lorenz curve calculated above is used as a threshold value to arrive at a single metric classification model for classifying plant embryos by their quantifiable characteristics. (Page 17, line 18, through page 18, line 31, of the specification.) The Lorenz curve and its threshold value,

found as described above, can be used to form a "single metric classification model," in which "values of a metric less than its threshold are assigned to one embryo quality [e.g., having desirable quantifiable characteristics] and values greater than the threshold are assigned to the other embryo quality class [e.g., having undesirable quantifiable characteristics]. (Page 17, lines 33-35.)

Third, raw digital image data are obtained from plant embryos of *unknown* quantifiable characteristics.

Fourth, the single metric classification model developed above is applied to the raw digital image data of embryos of unknown quantifiable characteristics, to thereby classify those plant embryos of unknown quantifiable characteristics according to their *presumed* quantifiable characteristics. (Page 17, line 18, through page 18, line 31, of the specification.)

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

In the final Office Action mailed June 20, 2005, all pending claims (Claims 1-14) were finally rejected under 35 U.S.C. § 112, first paragraph, as containing subject matter that was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Further, all the claims were found to contain subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Claims 1-14 were also rejected under 35 U.S.C. § 103(a) as being obvious over Chi et al. (*J. of Fermentation and Bioengineering 81*(5)) and/or Vits et al. (*AIChE Journal 40*(10)).

VII. ARGUMENT

Appellant respectfully submits that the Examiner's rejection of the present application under 35 U.S.C. § 112, first paragraph, under 35 U.S.C. § 102(b), and under 35 U.S.C. § 103(a) was in error and should be reversed.

1. The Specification as Filed Clearly Meets the Written Description Requirements Under Section 112, First Paragraph, for Claims 1-14

The Examiner has rejected Claims 1-14 under 35 U.S.C. § 112, first paragraph, as containing subject matter that was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s) had possession of the claimed invention.

More specifically, the Examiner found as follows:

> Applicant claims a method for classifying plant embryo's "quantifiable characteristics," yet within the specification as originally filed, there is no clear correlation drawn between the data collected and compared and the desired "quantifiable characteristics" of an embryo. Applicant has not clearly established what the correlation is and thus it is unclear that applicant actually had within their possession a method for actually classifying plant embryos....
>
> It follows logically that the claimed invention has not been enabled by the instant specification because applicant has not taught how to classify embryos *wherein the "raw spectral data" of an embryo with desired "quantifiable characteristics" is used as a standard to which embryos of unknown quality are compared* wherein if the data matches(?) then the unknown is classified as having desired quantifiable characteristics which would appear to be applicant's invention. The specification shows no correlation between "raw digital image data" and the desired characteristics but only between "raw digital image data" of one embryo and "raw digital image data" of a subsequent embryo.
>
> It would appear that applicant is claiming that if an unknown embryo has the same "raw digital image data" as the reference embryo then it has the same desired quantifiable characteristics but applicant has not set forth how a different result is to be classified. Thus applicant has not described or enabled how to classify an embryo. *What parameters or data would show that an embryo is of lesser desired quantifiable characteristics? Greater desired quantifiable characteristics?* There

> appears to be no indication of how the reference and model are used to classify the embryos of a desired quantifiable characteristic(s).

(Final Office Action, pages 4-5, emphasis added.)

As a preliminary matter, it is noted that the Examiner appears to have misunderstood the present invention as directed to directly comparing the raw digital image data of a reference embryo and the raw digital image data of an embryo having unknown characteristics. To the contrary, as discussed above, the present invention is directed to developing a *single metric classification model* by processing the raw digital image data collected from plural reference embryos, and then *applying the developed single metric classification model* to the raw digital image data of an embryo of unknown quantifiable characteristics.

In the above-quoted language, the Examiner appears to be asserting that the present specification has not clearly described a specific (or universal) correlation between the acquired raw digital image data from plant embryos and their quantifiable characteristics. In other words, the Examiner appears to be objecting to that the specification did not identify a particular set of "parameters or data" that can always be used as reliable indicators of specific quantifiable characteristics. For example, the Examiner appears to be demanding that the specification includes a specific correlation statement, such as "if a plant embryo has length X and width Y, then the embryo is deemed as likely to successfully germinate."

Appellant respectfully submits that the present invention is *not* directed to requiring to first identify a particular set of parameters or data that can be always used as indicative of specific quantifiable characteristics of plant embryos. To the contrary, the present invention is directed to developing a single metric classification model by (i) acquiring raw digital image data of reference embryos of known quantifiable characteristics; (ii) calculating a metric value from the acquired raw digital image data of each embryo of known quantifiable characteristics; (iii) dividing the metric values obtained above into two sets of metric values according to their known quantifiable characteristics; (iv) calculating a Lorenz curve from the

two sets of metric values; and (v) using any point on the Lorenz curve calculated above as a threshold value to arrive at a single metric classification model for classifying plant embryos by their quantifiable characteristics. Therefore, different single metric classification models are developed based on different sets of reference embryos, respectively.

Accordingly, appellant respectfully submits that the lack of disclosure of particular parameters or data that indicate specific quantifiable characteristics in this case does not raise any issue under 35 U.S.C. § 112, first paragraph, because the present invention as claimed is *not* directed to requiring to identify such parameters or data.

A specific example of the present invention is recited at page 25, line 21, through page 31, line 10, wherein Tables 4, 5, and 6 each explicitly shows the results of classifying embryos by using a Lorenz Curve classification method in accordance with the present invention of Claim 1. Still further, the Declaration filed in the present case on March 15, 2005, by inventor Toland sets forth facts that establish that the inventor had in his possession the invention as recited in Claims 1-14 of the present application.

In the final Office Action, the Examiner particularly rejected Claim 14 under § 112, first paragraph, noting that "there appears to be no adequate description for the specific qualities applicant claims in Claim 14." (Office Action, page 5, third paragraph.) Appellant notes that each and every example of quantifiable characteristics recited in Claim 14 is explicitly described in page 6, line 37, to page 7, line 7, of the application as filed.

Based on the foregoing, appellant respectfully submits that, contrary to the Examiner's finding, the specification as filed clearly describes the invention as claimed. Accordingly, appellant asserts that it is clear, in view of the specification as filed, that the inventor was in possession of the invention of Claims 1-14 directed to a method of classifying plant according to their quantifiable characteristics based on a single metric classification model. The specification describes how such a single metric classification model is developed and used. The first paragraph of § 112 does not require that a specific *universal* example of a single

metric classification model be described. Rather, one skilled in the art reading the present specification would recognize that the inventor had in his possession, at the time of filing, the invention directed to a method for classifying plant embryos according to their quantifiable characteristics comprising the steps recited in Claims 1-14. Accordingly, the Examiner's rejection of Claims 1-14 under 35 U.S.C. § 112, first paragraph was in error.

2. The Specification as Filed Clearly Meets the Enablement Requirement Under Section 112, First Paragraph, for Claims 1-14

In the final Office Action, the Examiner further found that the subject matter recited in Claims 1-14 was not described in the specification in such a way as to enable one skilled in the art to make and/or use the invention. Specifically, the Examiner noted that:

> It follows logically that the claimed invention has not been enabled by the instant specification because applicant has not taught how to classify embryos *wherein the "raw spectral data" of an embryo with desired "quantifiable characteristics" is used as a standard to which embryos of unknown quality are compared* wherein if the data matches(?) then the unknown is classified as having desired quantifiable characteristics which would appear to be applicant's invention. The specification shows no correlation between "raw digital image data" and the desired characteristics but only between "raw digital image data" of one embryo and "raw digital image data" of a subsequent embryo.
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> It would appear that applicant is claiming that if an unknown embryo has the same "raw digital image data" as the reference embryo then it has the same desired quantifiable characteristics but applicant has not set forth how a different result is to be classified. Thus applicant has not described or enabled how to classify an embryo. *What parameters or data would show that an embryo is of lesser desired quantifiable characteristics? Greater desired quantifiable characteristics?* There appears to be no indication of how the reference and model are used to classify the embryos of a desired quantifiable characteristic(s).

(Final Office Action, pages 4-5, emphasis added.)

As discussed in the previous section, the present application clearly describes the present invention directed to developing a single metric classification model by (i) acquiring raw digital image data of reference embryos of known quantifiable characteristics;

(ii) calculating a metric value from the acquired raw digital image data of each embryo of known quantifiable characteristics; (iii) dividing the metric values obtained above into two sets of metric values according to their known quantifiable characteristics; (iv) calculating a Lorenz curve from the two sets of metric values; and (v) using any point on the Lorenz curve calculated above as a threshold value to arrive at a single metric classification model for classifying plant embryos by their quantifiable characteristics. Appellant further respectfully submits that the specification clearly describes how a single metric classification model is developed based on data acquired from reference embryos of known quantifiable characteristics, and then is used to classify embryos of unknown quantifiable characteristics according to their presumed quantifiable characteristics. (See, for example, page 17, line 18, through page 18, line 31, of the specification.)

Accordingly, appellant respectfully submits that one skilled in the art reading the present specification would be enabled to practice the present invention.

3. Claims 1-14 are Nonobvious in View of Chi et al. and/or Vits et al. Under Section 103

Claims 1-14 stand rejected under 35 U.S.C. § 103(a) as being obvious over Chi et al. (*J. of Fermentation and Bioengineering 81*(5)) and/or Vits et al. (*AIChE Journal 40*(10)). Appellant respectfully submits that the rejection in view of Chi et al. and/or Vits et al. was also in error and submits the following arguments.

As discussed above, the present invention is directed to a method for classifying plant embryos according to their quantifiable characteristics, including generally four steps. First, raw digital image data are obtained from reference samples of plant embryos of known quantifiable characteristics. Second, a single metric classification model is developed based on the raw digital image data. Specifically, a single metric classification model is developed by: (i) calculating a metric value from the acquired raw digital image data of each embryo of known quantifiable characteristics; (ii) dividing the metric values obtained above into two sets of metric values according to their known quantifiable characteristics; (iii) calculating a

Lorenz curve from the two sets of metric values; and (iv) using any point on the Lorenz curve calculated above as a threshold value to arrive at a single metric classification model for classifying plant embryos by their quantifiable characteristics. Third, raw digital image data are obtained from a plant embryo of unknown quantifiable characteristics. Fourth, the developed single metric classification model is applied to the digital image data of the plant embryo of unknown quantifiable characteristics to classify the embryo according to its presumed quantifiable characteristics.

On the other hand, Chi et al. and Vits et al. are *completely* silent as to the development of a single metric classification model by calculating a Lorenz curve and using any point on the Lorenz curve as a threshold value.

Specifically, Chi et al. proposes to classify embryos based on "Fourier and size features" of an embryo. (Abstract.) Chi et al., after imaging each embryo, divides each embryo contour into 32 equal-length segments to give rise to 32 Fourier features, and considers those 32 Fourier and size features in classifying embryos. (Page 447, first column, second full paragraph, to second column. See also Figure 2.) Likewise, Vits et al. employs "size and size-independent morphological descriptors" in classifying embryos (Abstract). Like Chi et al., Vits et al. uses "32 arc-length intervals" (Figure 2) in evaluating an embryo image. Neither Chi et al. or Vits et al. describes a method of classifying plant embryos based on a single metric classification model developed by calculating a Lorenz curve and using any point on the Lorenz curve as a threshold value.

The Examiner apparently concedes this point, and thus makes a conclusive statement that to the extent that the subject matter of Claim 1 is not taught by Chi et al. and/or Vits et al., "the applicant uses known algorithms and programs to analyze the data and the use of such mathematic means would have been obvious." (Office Action, page 6.)

Appellant respectfully points out that the Examiner has not identified any prior art teaching related to calculation of Lorenz curves and their use as single metric classification

models for classifying plant embryos, as disclosed and claimed in the present application. As explained in the present specification, Lorenz curves were developed to compare income distribution among different groups of people. Such Lorenz curves were created by plotting the fraction of income versus the fraction of the population that owns that fraction of the income. These applications of Lorenz curves do *not* at all teach or suggest "using any point on the Lorenz curve ... as a threshold value to arrive at a single metric classification model for classifying plant embryos by their quantifiable characteristics," as explicitly recited in Claim 1.

In summary, neither Chi et al. or Vits et al. teaches or suggests the concept of the present invention as recited in Claim 1, and further, the Examiner has not identified any prior art teaching related to calculation of Lorenz curves and use of any points on the Lorenz curves as threshold values to arrive at single metric classification models for classifying plant embryos, as recited in Claim 1. Since the teaching directed to this aspect of Claim 1 is therefore *completely* missing in each of Chi et al., Vits et al., and the general knowledge in the art that the Examiner could point to, no *prima facie* case of obviousness has been made in the present case.

Accordingly, appellant respectfully submits that the rejection of Claim 1 under 35 U.S.C. § 103(a) in view of Chi et al. and/or Vits et al. was in error, and Claim 1 is allowable. Appellant further respectfully submits that dependent Claims 2-14 are also believed to be allowable for at least the same reasons why independent Claim 1 is allowable.

VIII. CLAIMS APPENDIX

1. A method for classifying plant embryos according to their quantifiable characteristics comprising:

(a) developing a single metric classification model by

(i) acquiring raw digital image data of reference samples of whole plant embryos or any portion thereof of known quantifiable characteristics;

(ii) calculating a metric value from the acquired raw digital image data of each embryo of known quantifiable characteristics;

(iii) dividing the metric values obtained in step (a)(ii) into two sets of metric values according to their known quantifiable characteristics;

(iv) calculating a Lorenz curve from the two sets of metric values;

(v) using any point on the Lorenz curve calculated in step (a)(iv) as a threshold value to arrive at a single metric classification model for classifying plant embryos by their quantifiable characteristics;

(b) acquiring raw digital image data of a whole plant embryo or any portion thereof of unknown quantifiable characteristics; and

(c) applying the developed single metric classification model to the raw digital image data of step (b) in order to

classify the plant embryo of unknown quantifiable characteristics according to its presumed quantifiable characteristics.

2. A method according to Claim 1, wherein two or more single metric classification models derived from different metrics are combined using one or more classification algorithms to develop a classification model for classifying plant embryos.

3. A method according to Claim 1, wherein the raw digital image data acquired in step (a)(i) is preprocessed using one or more preprocessing algorithms before step (a)(ii); the raw digital image data acquired in step (b) is preprocessed using one or more preprocessing algorithms; and step (c) is carried out using the preprocessed raw digital image data.

4. A method according to Claim 3, wherein the preprocessing algorithm removes raw image data that is not from the plant embryo or plant embryo organ.

5. A method according to Claim 3, wherein the preprocessing algorithm reduces the amount of raw image data.

6. A method according to Claim 1, wherein the raw digital image data is acquired from more than one view of the plant embryo or plant embryo organ.

7. A method according to Claim 1, wherein the quantifiable characteristics comprise morphology.

8. A method according to Claim 1, wherein the quantifiable characteristics comprise embryo conversion potential.

9. A method according to Claim 1, wherein the plant embryo is a plant somatic embryo.

10. A method according to Claim 9, wherein the plant is a tree.

11. A method according to Claim 10, wherein the tree is a member of the order *Coniferales*.

12. A method according to Claim 10, wherein the tree is a member of the family *Pinaceae*.

13. A method according to Claim 10, wherein the tree is selected from the group consisting of genera *Pseudotsuga* and *Pinus*.

14. The method according to Claim 1 wherein the quantifiable characteristics comprise conversion potential, resistance to pathogens, drought resistance, heat resistance, cold resistance, salt tolerance, preference for light quality, or suitability for long-term storage.

IX. EVIDENCE APPENDIX

None.

X. RELATED PROCEEDINGS APPENDIX

Copies of the Appellant Briefs concurrently filed in the related divisional applications, Application Nos. 09/700,037 and 10/680,675, are attached herewith.

Respectfully submitted,

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I hereby certify that this correspondence is being deposited in triplicate with the U.S. Postal Service in a sealed envelope as first class mail with postage thereon fully prepaid and addressed to Mail Stop Appeal Brief - Patents, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on the below date.

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Susan J. Finn

SIL:jam/ejh/mgp/dmg